Rec'd PCT/PTO 21 MAR 2002

dc-304666 FORM PTO 1390 U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE (REV 11-2000)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. § 371

ATTORNEY'S DOCKET NUMBER: 449122025100

U.S. APPLICATION NO (If known, see 37 CFR 1.5): 10/088686 Not yet assigned

INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/03239	September 18, 2000	September 21,1999

TITLE OF INVENTION

COMMUNICATIONS SYSTEM AND METHOD (AS AMENDED)

APPLICANT(S) FOR DO/EO/US

Antonius EMMERINK et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31)
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application under PCT Article 19 (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3 31 is included
13. ☒ A FIRST preliminary amendment
14. ☐ A SECOND or SUBSEQUENT preliminary amendment
15. ☒ A substitute specification.
16. ☐ A change of power of attorney and/or address letter
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U S C 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U S C 154(d)(4).
20. ☒ Other items 1) Application Data Sheet; 2) Int'l Search Report; 3) IPER; 4) Return receipt postcard.

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on March 21, 2002.

Melissa Garton

dc-308136

10/088686 Rec'd PCT/PTO 21 MAR 2002

PPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY DOCKET NO
ot yet assigned	PCT/DE00/03239	449122025100

21. ☒ The following fees are submitted

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

CALCULATIONS PTO USE ONLY

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,040.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provision of PCT Article 33(1)-(4) $710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =				$890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$0	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x $18.00	$0	
Independent claims	- 3 =		x $84.00	$0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $280.00	$0	
TOTAL OF ABOVE CALCULATIONS =				$890.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$0	
SUBTOTAL =				$890.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$0	
TOTAL NATIONAL FEE =				$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 per property** +				$40.00	
TOTAL FEES ENCLOSED =				$930.00	
				Amount to be refunded:	$
				charged:	$

a. ☒ Please charge my **Deposit Account No. 03-1952** (referencing Docket No. 449122025100) in the amount of $930.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

b. ☒ The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment to **Deposit Account No. 03-1952** (referencing Docket No. 449122025100).

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

END ALL CORRESPONDENCE TO:

Kevin R. Spivak
Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888

Kevin R. Spivak

SIGNATURE

Kevin R. Spivak
Registration No. 43,148

March 21, 2002

-308136

10/088686
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CERTIFICATE OF HAND DELIVERY
I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on March 21, 2002.
Melissa Garton

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Antonius EMMERINK et al.

Serial No.: Not yet assigned

Filing Date: March 21, 2002

For: COMMUNICATIONS SYSTEM AND METHOD (AS AMENDED)

Examiner: Not yet assigned

Group Art Unit: Not yet assigned

PRELIMINARY AMENDMENT

BOX PCT
Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, please amend this application as follows:

In the Claims:

Please cancel claims 1-8.

Please add new claims 9-19 as follows:

What is claimed is:

9. (New) A method for setting up and clearing a communications link, comprising:

producing control information in a central control device, which control information defines a link via a switching matrix for time slot links for PCM data paths;

controlling transport-network specific call processing, using the control information, in a transport network for transporting communications data via the communications link, and

setting up a communications link by using the call processing and at least one connection element which is set up in the transport network.

10088686.032102

10. (New) The method as claimed in claim 9, wherein the call processing is performed by decentralized switching devices in the transport network, and the communications link is set up via a permanent connection element between two decentralized switching devices.

11. (New) The method as claimed in claim 9, wherein the communications links are set up via at least one permanent virtual connection.

12. (New) The method as claimed in claim 9, wherein the communications link is set up via an ATM transport network.

13. (New) A system for setting up and clearing, a communications link, comprising:

a transport network to provide a communications link;

a control network to control the setting up and/or clearing of the communications link; and

a first device to control the setting up and/or clearing of connections in the transport network via the control network, the device being arranged physically separately from the transport network, wherein

the transport network has at least two decentralized switching devices to provide a communications link in the transport network, with at least one communications link via the transport network between the decentralized switching devices.

14. (New) The arrangement as claimed in claim 13, in which the permanent communications link is in the form of a permanent virtual connection.

15. (New) The arrangement as claimed in claim 13, in which the transport network is in the form of an ATM network.

16. (New) The arrangement as claimed in claim 13, in which there are communications links between the decentralized switching devices.

17. (New) The arrangement as claimed in claim 14, in which the transport network is in the form of an ATM network.

18. (New) The arrangement as claimed in claim 14, in which there are communications links between the decentralized switching devices.

19. (New) The arrangement as claimed in claim 15, in which there are communications links between the decentralized switching devices.

In the Abstract:

Please replace the Abstract with the substitute Abstract attached hereto.

REMARKS

Amendments to the specification have been made and are submitted herewith in the attached Substitute Specification. A clean copy of the specification and a marked-up version showing the changes made are attached herewith. The claims and abstract have been amended in the attached Preliminary Amendment. All amendments have been made to place the application in proper U.S. format and to conform with proper grammatical and idiomatic English. None of the amendments herein are made for reasons related to patentability. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 449122025100. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

Dated: March 21, 2002

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

For the convenience of the Examiner, the changes made are shown below with deleted text in strikethrough and added text in underline.

In the Claims:

Please cancel claims 1-8.

Please add new claims 9-19 as follows:

What is claimed is:

9. (New) A method for setting up and clearing a communications link, comprising:

producing control information in a central control device, which control information defines a link via a switching matrix for time slot links for PCM data paths;

controlling transport-network specific call processing, using the control information, in a transport network for transporting communications data via the communications link, and

setting up a communications link by using the call processing and at least one connection element which is set up in the transport network.

10. (New) The method as claimed in claim 9, wherein the call processing is performed by decentralized switching devices in the transport network, and the communications link is set up via a permanent connection element between two decentralized switching devices.

11. (New) The method as claimed in claim 9, wherein the communications links are set up via at least one permanent virtual connection.

12. (New) The method as claimed in claim 9, wherein the communications link is set up via an ATM transport network.

13. (New) A system for setting up and clearing, a communications link, comprising:

a transport network to provide a communications link;

a control network to control the setting up and/or clearing of the communications link; and

a first device to control the setting up and/or clearing of connections in the transport network via the control network, the device being arranged physically separately from the transport network, wherein

the transport network has at least two decentralized switching devices to provide a communications link in the transport network, with at least one communications link via the transport network between the decentralized switching devices.

14. (New) The arrangement as claimed in claim 13, in which the permanent communications link is in the form of a permanent virtual connection.

15. (New) The arrangement as claimed in claim 13, in which the transport network is in the form of an ATM network.

16. (New) The arrangement as claimed in claim 13, in which there are communications links between the decentralized switching devices.

17. (New) The arrangement as claimed in claim 14, in which the transport network is in the form of an ATM network.

18. (New) The arrangement as claimed in claim 14, in which there are communications links between the decentralized switching devices.

19. (New) The arrangement as claimed in claim 15, in which there are communications links between the decentralized switching devices.

In the Abstract:

Please replace the Abstract with the substitute Abstract attached hereto.

COMMUNICATIONS SYSTEM

Abstract

A method and an arrangement are specified for setting up and clearing communications links via a private branch exchange. The transport network for transporting the communications data is preferably in the form of an ATM network, and is controlled by a separate control network, which is separated from it. In one particular refinement, all the decentralized switching devices which are involved are connected to one another via the transport network with the aid of virtual paths. This ensures that the setting up of connections via the transport network needs the same amount of time between any given communications subscribers. The time delay caused by the process of setting up connections occurs only during the initialization process of the transport network, in which these virtual communications links are set up in the transport network.

Serial No. Not yet assigned
Docket No. 449122025100

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COMMUNICATIONS SYSTEM AND METHOD

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/03239 which was published in the German language on September 18, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and an arrangement for setting up and clearing communications links, and in particular, for a private branch exchange and the terminals connected to it.

BACKGROUND OF THE INVENTION

Owing to the increasing amount of communications traffic resulting from the increasing number of communications subscribers, and from the increasing requirements for the amount of data to be transmitted, transmitting devices, in particular private branch exchanges, are subject to ever more severe requirements in terms of the amount of data to be transmitted by a communications link and the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM method (Time Division Multiplexing) in which communications data from different connections is transmitted in respectively defined time slots. A connection between different communications partners is produced by a switching matrix which, on the basis of control information, associates incoming time slots on an incoming connection with outgoing time slots on an outgoing connection. Such switching matrices generally have a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices such as these are subject to a further problem, in that the time slots can hold only a limited amount of data.

SUMMARY OF THE INVENTION

In one embodiment of the invention, there is a method and an arrangement for providing a communications link, which ensure a high level of flexibility with regard to adaptation to the number of communications links to be provided, to the amount of communication traffic per connection, and to their physical extent, while one particular aim is to ensure that any time delay caused by switching has no disadvantageous effects on the handling of a connection.

In an exemplary method according to the invention, a connection is advantageously set up by means of call processing via an already existing fixed connection element in the transport network since this means that there is no need for a possibly time-consuming connection process in the transport network at that particular time. This advantage becomes more important the greater the number of switching stations in the transport network that are involved in the connection when setting up a connection via different connection element paths.

In one aspect of the method, the call processing is carried out particularly advantageously in decentralized switching devices since this makes it possible to achieve a high level of redundancy in the transport network, and, in the situation where a number of such switching devices are connected to one another, between which permanently established connection element paths are set up, the setting up of a connection in the transport network takes just as long, even via a number of decentralized switching devices, as if ~~only~~ two such decentralized switching devices were involved in the setting up of the communications links. This ensures that the setting up of connections between different communication subscribers in the transport network requires approximately the same amount of time, and the number of decentralized

switching devices that are actually involved in setting up the connection is of secondary importance.

In another aspect of the method, such a communications link is set up particularly advantageously by means of virtual transport network connections since, with regard to the connection times, these offer approximately the same connection setting-up times as hard-wired connections, although the transport network topology can be kept very simple and can be designed in a flexible manner, to satisfy the requirements. This leads to a considerable reduction in the amount of wiring required.

In one embodiment of the arrangement, the communications links are set up between communications subscribers via a transport network which is controlled by a control network, with decentralized switching devices in the transport network carrying out the connection tasks in the network. If there is a permanent communications link between at least two such decentralized switching devices, an arrangement such as this reduces the amount of time required to pass connections through the transport network.

Permanent, in this example, equals there is no need for setting up connections.

One aspect of the arrangement has a permanent connection in the form of a permanent virtual connection, since such permanent virtual connections can be set up independently of the network topology of the transport network at any given time, and no time is lost for setting up connections, since permanent connections are not set up dynamically as required, but may be set up once, on a static basis, independently of the requirement, and are then available.

It is particularly advantageous for the transport network to be in the form of an ATM network, since the

various network components for ATM networks are already available commercially, that is to say the technical complexity for setting up a transport network is as low as desired, and the setting up of permanent virtual connections is already available as a service feature for ATM networks.

In another aspect of the arrangement, the decentralized switching devices in the transport network are connected to one another in a particularly advantageous manner via permanent virtual connections since, in this way, the time for setting up connections between any given decentralized switching devices via the transport network is approximately constant, and is independent of the number of such decentralized switching devices that are involved in the setting up of the communications link via the transport network.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention will be explained in more detail in the following text with reference to figures, in which:

Figure 1 shows a conventional communications arrangement.

Figure 2 shows an example of a novel communications arrangement.

Figure 3 shows an example of a message sequence in a known switching system.

Figure 4 shows an example of a message sequence using time-slot-related connection information for the transport network.

Figure 5 shows a communications arrangement with permanent connections.

Figure 6 shows a communications arrangement with transport network connections via a public network.

Figure 7 shows a complex communications arrangement with virtual paths.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows an example of a known private branch exchange 150 with two peripheral devices P1 and P2, to each of which a communications terminal KE1 and KE2, which operates on a digital or analog basis, is connected. These peripheral devices P1 and P2 are accommodated in the same physical area as the central device ZE1. By way of example, they are located in the same room or in the same cabinet as it. The terminals fill defined time slots in a PCM datastream (Pulse Code Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are respectively connected to subscriber line modules SLM01 and SLM02 which supply, or take from, the PCM datastream digital data which is intended for the respective terminals, or originates from the respective terminals, via time slots defined by signaling. These PCM datastreams are annotated by 100 and 200, respectively, in Figure 1. Furthermore, signaling connections are shown, which are annotated 110 and 210, respectively. It shall be noted that, in this case, this is only a logical representation and not a physical representation. However, in reality, the transport data and the signaling data are transmitted in the same connecting cable.

This figure also shows peripheral devices P1 and P2, as well as line trunk units LTUC1 and LTUC2, which control the data traffic to the subscriber line modules for the respective decentralized devices. The peripheral device P1 is supplied with signaling data via the line 110, and the peripheral device P2 is supplied with signaling data via the signaling line 210.

As can clearly be seen here, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are gathered and distributed by a signaling device DCL, and are interchanged between the central device ZE1 and the peripheral devices P1, P2.

The call processing CP controls the setting up and clearing of connections and, for this purpose, controls, inter alia, appliance-specific interface functions DH which, for example, are in the form of program modules. In this case, setting commands 1 are produced for the switching matrix MTS. These setting commands essentially indicate which input of the switching matrix should be connected to which output in order to produce a communications link. The control and connection functions are thus carried out by a single physically integrated functional unit in the communications network.

Figure 2 shows an example of a flexible, high-performance arrangement for setting up communications links. By way of example, this arrangement shows the configuration of a private branch exchange 250.

Figure 2 uses the same reference symbols for the same components of the device as those shown in Figure 1. Turning now to Figure 2, it is immediately clear that this shows a separate transport network 700 and a separate control network 310/410. This configuration of a switching system has the advantage that already existing networks, such as public or private networks, can be used for the transport network. In this case, ~~only~~ the control network is routed to the central device ZE2.

The digital or analog communications terminals KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLM01 and SLM02. However, without any restriction to the invention, terminals are also feasible, and can be integrated, in an arrangement 250 such as this, which can be connected directly to the transport network 700, without any diversion, and without any SLMO. ATM terminals or even IP-based (Internet Protocol) terminals can thus also be connected.

As can also be seen, the decentralized devices DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used for connection tasks. Instead of this, the connection tasks are carried out by the transport network.

In this arrangement, at least one control information item, which is derived from time-slot-related control information, is in each case provided for setting up the communications link for this purpose, for the respective decentralized switching devices CS1 and CS2, via the control lines 410 and 310. The figure furthermore shows that PCM data is converted to cell data in accordance with the standard for the transport network type 700, that is, for example, ATM cell data, on a respective data path 300 or 400. In this case, it should be noted that the use of an ATM network as the transport network is intended to be only an exemplary embodiment here. Ethernets, other IP links or even TDM links may likewise be used for this purpose. The choice is dependent on the intended application, and covers the entire range of available networks both in the narrowband field and in the broadband field.

Call processing is preferably carried out as a function of the transport network on the decentralized switching devices CS1 and CS2, but this is essentially restricted to the basic call functionality. Service features are in this case provided by the central controller ZE2. Connections between the various decentralized devices are controlled by the central device ZE2 via signaling. The advantages of this control arrangement are that it can be used for both narrowband and broadband. Furthermore, the transport network will be set up on both public networks and private networks, or on a mixture of the two.

In simplified form and by way of example, Figure 3 shows a message sequence in a conventional communications system for setting up a connection between two peripheral devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, or control messages, runs from top to bottom. First, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then selected by entering dialing information, which is passed on from an appliance-specific interface module DH to the call processing CP for the subscriber A.

The selection code interpretation WABE of the dialed information leads to a message SEIZURE being passed on to the call processing CP for the subscriber B. An appliance-specific interface module DH, which has the responsibility there, assigns an explicit time slot, for example ZS1 for a defined PCM data path, for example PD1, to that connection, and generates the control message TSL_ASSIGN to the subscriber line module SLM01. This control message tells the subscriber line module SLM01 the explicit time slot ZS1 and the defined PCM data path PD1 which shall be used for that connection. The explicit time slot ZS1 in the PCM data path PD1 is applicable to the connection element between the subscriber line module SLM01 and the MTS. A second explicit time slot ZS2 in a second explicitly defined PCM data path PD2 is applicable to the connection element between the MTS and the subscriber line module SLM02. The information ZS2 and PD2 is once again sent to the subscriber line module SLM02 in a control message TSL ASSIGN. Generally, TDM-based private branch exchanges use a TDM switching matrix MTS for the physical connection of individual subscribers. A setting command PATH_CONNECT1 is sent for this switching matrix and results in the time slot ZS1 from the PCM data path PD1 being connected to the time slot ZS2 for the PCM data path PD2. The two connection

elements are thus connected to form a continuous path between SLM01 and SLM02.

Figure 4 shows, in simplified form and by way of example, a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. An ATM network is used, by way of example, as the transport network here. The time sequence of the messages, or signaling messages, is from top to bottom. A functional unit STMA converts the time slots of the PCM datastream to a cell stream of ATM cells. In Figure 2, one such device is integrated in each of the decentralized switching devices CS1 and CS2 and, for this reason, they are not shown separately.

The sequence differs from the sequence illustrated in Figure 3 from the point where the setting command PATH_CONNECT1 is set for the TDM switching matrix. Instead of a setting command PATH_CONNECT1, a control message PATH_CONN2 is generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection in the transport network. When using an ATM transport network, by way of example, an ATMSVC (ATM Switched Virtual Connection) is set up by means of ATM signaling procedures.

The control message PATH_CONN2 includes the time slot and data path information ZS and PD for this purpose, and this can be taken, for example, directly from the setting message PATH_CONNECT1. In addition, the central control device states the transport-network-dependent address of the decentralized switching device to which the connection is intended to be set up. This means that the data which is provided for the central controller as information about the transport network is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device in turn determines

the necessary addresses from the time slot and data path information ZS and PD. Association tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

The control message PATH_CONN2 may also include other information, and the control message PATH_CONNECT may also be generated in a number of more specific versions. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also include information about the desired bandwidth. Alternatively, the bandwidth information can also be interchanged directly between the subscriber line module and the switching device.

If, after receiving the PATH_CONN2, the decentralized switching devices set up a connection in the transport network 700, the user data is then transmitted via this transport network 700. The user data stream of the data path 300/400 between the subscriber line module and the decentralized device DZ is associated with a connection between DZ1 and DZ2 by mapping the time slot details ZS and PD to form a connection identifier for that connection. This means that, although the sequences for setting up connections via the transport network on the central control ZE2 may be complicated, these addresses are passed on to the call processing of the transport network in order to produce a connection via it. Everything else is done by the transport-network-specific call processing.

According to this message sequence, the PATH_CONNECT command is thus replaced by call processing that is specific to the transport network. In order to allow TDM-based subscribers to be connected by means of decentralized switching devices independently of the transport network, time slots are converted to transport units. This is done in a conversion unit such as an STMA, of which there is at least one for each decentralized device, and this is preferably looped

into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway may be provided for this purpose.

The TDM-based subscriber modules communicate with the conversion unit via, for example, connections on the backplane motherboard of the respective decentralized device. A bus which connects the modules to one another can be provided for this purpose on this motherboard. The setting commands for connection of the conversion unit are for this purpose preferably produced autonomously from the PATH_CONN2 message by the decentralized switching device.

However, the method is not restricted to dialed connections that are set up dynamically, but can likewise use an ATMPVC (ATMPVC Permanent virtual connection). The information relating to the address is then exchanged for information controlling the use of fixed connections. Furthermore, other forms of data transmission may also be used, such as IP connections.

Figure 5 shows the example of a communications system which is controlled by a control network and has a transport network 700. In these illustrated arrangements, the reference symbols are used analogously to the descriptions relating to the other figures. In the present example, three decentralized devices DZ1, DZ2 and DZN are shown, with dots being shown between DZ2 and DZN, which are intended to indicate that there may be any desired number of such devices between the decentralized device DZ2 and the decentralized device DZN, and these are likewise a part of such a communications arrangement.

Connection elements 71, 712, 72N lead from the transport network 700 to the decentralized switching devices CS1, CS2 and CSN, and are passed back via a further connection 7N7 into the transport network. This means that the decentralized devices are in this case connected in series in the transport network or, to be

more precise, these decentralized switching devices are connected to these decentralized devices via the transport network, which is closed in the form of a loop.

As can also be seen, communications links exist between the individual decentralized switching devices CS1, CS2 and CSN via the transport network, with two of these being annotated 1N and 2N here. In this case, these are the virtual paths between the decentralized switching devices CS1 and CSN, or CS2 and CSN. This illustration shows that the use of virtual paths between the decentralized switching devices can result in a very complex structure. This is evident just from the description of the small number of virtual connections shown here. It can likewise be seen that the topology of the transport network can be kept very simple in comparison to this. The use of such permanent virtual paths in the transport network has the advantage that the connection setting-up times for communications links via the transport network between communications subscribers is virtually constant for any desired decentralized devices, since the fact that virtual paths have been set up means that the number of relay stations involved in setting up connections, in the form of decentralized switching devices, is irrelevant The transport network is preferably in the form of an ATM network, since the standardized service feature for setting up virtual paths already exists for networks such as these. The virtual paths are advantageously initialized and set up in the transport network ~~only~~ once, when starting up the communications arrangement, and then exist throughout the period during which this arrangement is in operation. They are used by current communications links, in accordance with the control information which is sent via the control network, only by the call processing, which is carried out in the decentralized switching devices CS and is controlled via the control network, which is not illustrated here.

Figure 6 shows a further communications arrangement comprising three decentralized devices DZ1 to DZ3, in which central switching devices CS1 to CS3 are arranged. Virtual communication paths 12, 23 and 31 exist between the decentralized switching devices. In this case, the transport network 700 is in the form of a public ATM network. This means that the virtual paths 701, 702 and 703 run via a public network. In a situation where the decentralized switching devices CS1 to CS3 are connected to one another via a public network and no virtual paths are established between them, it is possible, when setting up a connection, for the delay times via the transport network to become so great that the standardized connection setting-up times can no longer be complied with,' as defined in the communications standard used in such a communications arrangement. The setting up of virtual paths in the transport network, particularly in the case of public transport networks, thus advantageously ensures that the connection setting-up times via the transport network can be kept short.

Figure 7 shows a more complex communication arrangement, in which all the decentralized switching devices are connected to one another by virtual paths. For the sake of clarity, the decentralized switching device CS1 is shown completely, and the other decentralized switching devices are numbered successively in sequence, by the numbers 2 to 16.

In this case, the transport network is in the form of a matrix-like row and column structure, which connects the individual decentralized switching devices to one another. Of these, only DZ1 is shown in the present example since, in the wider context, these contribute nothing to the understanding of the figure. The transport network thus comprises columns 701, 702, 703 and 704, which connect respective decentralized switching devices CS1, 5, 9, 13; 2, 6, 10, 14; 3, 7, 11, 15 and 4, 8, 12, 16 to one another. In the rows of

the network, CS1, 2, 3, 4 are connected to one another by the transport network via 107, 5, 6, 7, 8 are connected to one another via 507, 9, 10, 11, 12 are connected to one another via 907, and 13, 14, 15, 16 are connected to one another via 1307. Even the use of 16 decentralized switching devices in a communications arrangement thus results in a highly complex transport network topology. However, the structure becomes disproportionately more complex if virtual paths are set up between the individual decentralized switching devices in order to keep the connection setting-up time via the entire communications arrangement constant between communications subscribers and any given decentralized devices. The virtual paths for a single decentralized switching device 6 to the other decentralized switching devices are shown here. However, it should be noted in this case that such a star-shaped virtual path configuration exists between the decentralized switching devices 1 to 16. In detail, virtual paths 61, 62, 63, 64, 616, 613, 69 and 65 originate from 6 going to the other decentralized switching devices, although it should be noted that, in order to make the illustration clearer, this figure does not show the virtual paths. In order to ensure a short connection setting-up time for communications links via this communications arrangement between the decentralized switching devices it is, however, necessary for the decentralized switching devices to be connected to the other decentralized switching devices via virtual paths.

An arrangement such as this in conjunction with the procedure for establishing a communications link ensures that the connection setting-up times and the delays associated with them between the individual decentralized switching devices occur when starting up such a communications arrangement, during which process the virtual paths are initialized via the ATM network, while these times are short when actually setting up a communications link between communications subscribers

who are connected to any given decentralized devices, since these links run via virtual paths.

~~Description~~

COMMUNICATIONS SYSTEM AND METHOD

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/03239 which was published in the German language on September 18, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and an arrangement for setting up and clearing communications links, and in particular, for ~~the purposes of~~ a private branch exchange and the terminals connected to it.

BACKGROUND OF THE INVENTION

Owing to the increasing amount of communications traffic resulting from the increasing number of communications subscribers, and from the increasing requirements for the amount of data to be transmitted, transmitting devices, in particular private branch exchanges, are subject to ever more severe requirements in terms of the amount of data to be transmitted by a communications link and the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM method (Time Division Multiplexing) in which communications data from different connections is transmitted in respectively defined time slots. A connection between different communications partners is produced by a switching matrix which, on the basis of control information, associates incoming time slots on an incoming connection with outgoing time slots on an outgoing connection. Such switching matrices generally have a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices

such as these are subject to a further problem, in that the time slots can hold only a limited amount of data.

SUMMARY OF THE INVENTION

~~The object on which the invention is based is to specify~~ In one embodiment of the invention, there is a method and an arrangement for providing a communications link, which ensure a high level of flexibility with regard to adaptation to the number of communications links to be provided, to the amount of communication traffic per connection, and to their physical extent, while one particular aim is to ensure that any time delay caused by switching has no disadvantageous effects on the handling of a connection.

~~This object is achieved according to the features of patent claim 1 for the method, and according to the features of patent claim 5 for the arrangement. Developments of the invention can be found in the dependent claims.~~

In an exemplary ~~the~~ method according to the invention, a connection is advantageously set up by means of call processing via an already existing fixed connection element in the transport network since this means that there is no need for a possibly time-consuming connection process in the transport network at that particular time. This advantage becomes more important the greater the number of switching stations in the transport network that are involved in the connection when setting up a connection via different connection element paths.

In one ~~development~~ aspect of the ~~described~~ method, the call processing is carried out particularly advantageously in decentralized switching devices since this makes it possible to achieve a high level of redundancy in the transport network, and, in the situation where a number of such switching devices are

connected to one another, between which permanently established connection element paths are set up, the setting up of a connection in the transport network takes just as long, even via a number of decentralized switching devices, as if ~~only~~ two such decentralized switching devices were involved in the setting up of the communications links. This ensures that the setting up of connections between different communication subscribers in the transport network requires approximately the same amount of time, and the number of decentralized switching devices that are actually involved in setting up the connection is of secondary importance.

In ~~one development~~ another aspect of the ~~described~~ method, such a communications link is set up particularly advantageously by means of virtual transport network connections since, with regard to the connection times, these offer approximately the same connection setting-up times as hard-wired connections, although the transport network topology can be kept very simple and can be designed in a flexible manner, to satisfy the requirements. This leads to a considerable reduction in the amount of wiring required.

In one ~~particularly advantageous~~ embodiment of the arrangement, the communications links are set up between communications subscribers via a transport network which is controlled by a control network, with decentralized switching devices in the transport network carrying out the connection tasks in the network. If there is a permanent communications link between at least two such decentralized switching devices, an arrangement such as this reduces the amount of time required to pass connections through the transport network.

Permanent, in this example, equals ~~=~~ there is no need for setting up connections.

GR 99 P 2865

~~Description~~

COMMUNICATIONS SYSTEM AND METHOD

CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/03239 which was published in the German language on September 18, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and an arrangement for setting up and clearing communications links, and in particular, for ~~the purposes of~~ a private branch exchange and the terminals connected to it.

BACKGROUND OF THE INVENTION

Owing to the increasing amount of communications traffic resulting from the increasing number of communications subscribers, and from the increasing requirements for the amount of data to be transmitted, transmitting devices, in particular private branch exchanges, are subject to ever more severe requirements in terms of the amount of data to be transmitted by a communications link and the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM method (Time Division Multiplexing) in which communications data from different connections is transmitted in respectively defined time slots. A connection between different communications partners is produced by a switching matrix which, on the basis of control information, associates incoming time slots on an incoming connection with outgoing time slots on an outgoing connection. Such switching matrices generally have a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices

Figure 1 shows a conventional communications arrangement.~~;~~

Figure 2 shows an example of a novel communications arrangement.~~;~~

Figure 3 shows an example of a message sequence in a known switching system.

Figure 4 shows an example of a message sequence using time-slot-related connection information for the transport network.

Figure 5 shows a communications arrangement with permanent connections.~~;~~

Figure 6 shows a communications arrangement with transport network connections via a public network.~~;~~ ~~and~~

Figure 7 shows a complex communications arrangement with virtual paths.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows an example of a known private branch exchange 150 with two peripheral devices P1 and P2, to each of which a communications terminal KE1 and KE2, which operates on a digital or analog basis, is connected. These peripheral devices P1 and P2 are accommodated in the same physical area as the central device ZE1. By way of example, they are located in the same room or in the same cabinet as it. The terminals fill defined time slots in a PCM datastream (Pulse Code Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are respectively connected to subscriber line modules SLM01 and SLM02 which supply, or take from, the PCM datastream digital data which is intended for the respective terminals, or originates from the respective terminals, via time slots defined by signaling. These PCM datastreams are annotated by 100 and 200, respectively, in Figure 1. Furthermore, signaling connections are shown, which are annotated 110 and 210, respectively. It shall be noted that, in this case, this is only a logical representation and not a physical representation. However, in reality, the

who are connected to any given decentralized devices, since these links run via virtual paths.

transport data and the signaling data are transmitted in the same connecting cable.

This figure also shows peripheral devices P1 and P2, as well as line trunk units LTUC1 and LTUC2, which control the data traffic to the subscriber line modules for the respective decentralized devices. The peripheral device P1 is supplied with signaling data via the line 110, and the peripheral device P2 is supplied with signaling data via the signaling line 210.

As can clearly be seen here, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are gathered and distributed by a signaling device DCL, and are interchanged between the central device ZE1 and the peripheral devices P1, P2. The call processing CP controls the setting up and clearing of connections and, for this purpose, controls, inter alia, appliance-specific interface functions DH which, for example, are in the form of program modules. In this case, setting commands 1 are produced for the switching matrix MTS. These setting commands essentially indicate which input of the switching matrix should be connected to which output in order to produce a communications link. The control and connection functions are thus carried out by a single physically integrated functional unit in the communications network.

Figure 2 shows an example of a flexible, high-performance arrangement for setting up communications links. By way of example, this arrangement shows the configuration of a private branch exchange 250.

Figure 2 uses the same reference symbols for the same components of the device as those shown in Figure 1. Turning now to Figure 2, it is immediately clear that this shows a separate transport network 700 and a separate control network 310/410. This configuration of

a switching system has the advantage that already existing networks, such as public or private networks, can be used for the transport network. In this case, ~~only~~ the control network ~~need be~~ is routed to the central device ZE2.

The digital or analog communications terminals KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLM01 and SLM02. However, without any restriction to the invention, terminals are also feasible, and can be integrated, in an arrangement 250 such as this, which can be connected directly to the transport network 700, without any diversion, and without any SLMO. ATM terminals or even IP-based (Internet Protocol) terminals can thus also be connected.

As can also be seen, the decentralized devices DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used for connection tasks. Instead of this, the connection tasks are carried out by the transport network.

In this arrangement, at least one control information item, which is derived from time-slot-related control information, is in each case provided for setting up the communications link for this purpose, ~~just~~ for the respective decentralized switching devices CS1 and CS2, via the control lines 410 and 310. The figure furthermore shows that PCM data is converted to cell data in accordance with the standard for the transport network type 700, that is, for example, ATM cell data, on a respective data path 300 or 400. In this case, it should be noted that the use of an ATM network as the transport network is intended to be only an exemplary embodiment here. Ethernets, other IP links or even TDM links may likewise be used for this purpose. The choice is dependent on the intended application, and covers

the entire range of available networks both in the narrowband field and in the broadband field.

Call processing is preferably carried out as a function of the transport network on the decentralized switching devices CS1 and CS2, but this is essentially restricted to the basic call functionality. Service features are in this case provided by the central controller ZE2. Connections between the various decentralized devices are controlled by the central device ZE2 via signaling. The advantages of this control arrangement are that it can be used for both narrowband and broadband. Furthermore, the transport network will be set up on both public networks and private networks, or on a mixture of the two.

In simplified form and by way of example, Figure 3 shows a message sequence in a conventional communications system for setting up a connection between two peripheral devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, or control messages, runs from top to bottom. First ~~of all~~, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then selected by entering dialing information, which is passed on from an appliance-specific interface module DH to the call processing CP for the subscriber A.

The selection code interpretation WABE of the dialed information leads to a message SEIZURE being passed on to the call processing CP for the subscriber B. An appliance-specific interface module DH, which has the responsibility there, assigns an explicit time slot, for example ZS1 for a defined PCM data path, for example PD1, to that connection, and generates the control message TSL_ASSIGN to the subscriber line module SLM01. This control message tells the subscriber line module SLM01 the explicit time slot ZS1 and the

defined PCM data path PD1 which shall be used for that connection. The explicit time slot ZS1 in the PCM data path PD1 is applicable to the connection element between the subscriber line module SLM01 and the MTS. A second explicit time slot ZS2 in a second explicitly defined PCM data path PD2 is applicable to the connection element between the MTS and the subscriber line module SLM02. The information ZS2 and PD2 is once again sent to the subscriber line module SLM02 in a control message TSL ASSIGN. Generally, TDM-based private branch exchanges use a TDM switching matrix MTS for the physical connection of individual subscribers. A setting command PATH_CONNECT1 is sent for this switching matrix and results in the time slot ZS1 from the PCM data path PD1 being connected to the time slot ZS2 for the PCM data path PD2. The two connection elements are thus connected to form a continuous path between SLM01 and SLM02.

Figure 4 shows, in simplified form and by way of example, a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. An ATM network is used, by way of example, as the transport network here. The time sequence of the messages, or signaling messages, is from top to bottom. A functional unit STMA converts the time slots of the PCM datastream to a cell stream of ATM cells. In Figure 2, one such device is integrated in each of the decentralized switching devices CS1 and CS2 and, for this reason, they are not shown separately.

The sequence differs from the sequence illustrated in Figure 3 ~~only~~ from the point where the setting command PATH_CONNECT1 is set for the TDM switching matrix. Instead of a setting command PATH_CONNECT1, a control message PATH_CONN2 is generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection in the transport network. When using an ATM transport network,

by way of example, an ATMSVC (ATM Switched Virtual Connection) is set up by means of ATM signaling procedures.

The control message PATH_CONN2 ~~must contain~~ includes the time slot and data path information ZS and PD for this purpose, and this can be taken, for example, directly from the setting message PATH_CONNECT1. In addition, the central control device ~~just needs to~~ states the transport-network-dependent address of the decentralized switching device to which the connection is intended to be set up. This means that the data which ~~must be~~ is provided for the central controller as information about the transport network is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device in turn determines the necessary addresses from the time slot and data path information ZS and PD. Association tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

The control message PATH_CONN2 may also ~~contain~~ include other information, and the control message PATH_CONNECT may also be generated in a number of more specific versions. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also ~~contain~~ include information about the desired bandwidth. Alternatively, the bandwidth information can also be interchanged directly between the subscriber line module and the switching device.

If, after receiving the PATH_CONN2, the decentralized switching devices set up a connection in the transport network 700, the user data is then transmitted via this transport network 700. The user data stream of the data path 300/400 between the subscriber line module and the decentralized device DZ is associated with a connection between DZ1 and DZ2 by mapping the time slot details ZS and PD to form a connection identifier for that

connection. This means that, although the sequences for setting up connections via the transport network on the central control ZE2 may be complicated, ~~only~~ these addresses ~~need be~~ are passed on to the call processing of the transport network in order to produce a connection via it. Everything else is done by the transport-network-specific call processing.

According to this message sequence, the PATH_CONNECT command is thus replaced by call processing that is specific to the transport network. In order to allow TDM-based subscribers to be connected by means of decentralized switching devices independently of the transport network, ~~it is necessary to convert~~ time slots are converted to transport units. This is done in a conversion unit such as an STMA, of which there is at least one for each decentralized device, and this is preferably looped into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway may be provided for this purpose.

The TDM-based subscriber modules communicate with the conversion unit via, for example, connections on the backplane motherboard of the respective decentralized device. A bus which connects ~~all~~ the modules to one another can be provided for this purpose on this motherboard. The setting commands for connection of the conversion unit are for this purpose preferably produced autonomously from the PATH_CONN2 message by the decentralized switching device.

However, the method is not restricted to dialed connections that are set up dynamically, but can likewise use an ATMPVC (ATMPVC Permanent virtual connection). The information relating to the address ~~must~~ is then ~~be~~ exchanged for information controlling the use of fixed connections. Furthermore, other forms of data transmission may also be used, such as IP connections.

Figure 5 shows the example of a communications system which is controlled by a control network and has a transport network 700. In these illustrated arrangements, the reference symbols are used analogously to the descriptions relating to the other figures. In the present example, three decentralized devices DZ1, DZ2 and DZN are shown, with dots being shown between DZ2 and DZN, which are intended to indicate that there may be any desired number of such devices between the decentralized device DZ2 and the decentralized device DZN, and these are likewise a part of such a communications arrangement.

Connection elements 71, 712, 72N lead from the transport network 700 to the decentralized switching devices CS1, CS2 and CSN, and are passed back via a further connection 7N7 into the transport network. This means that the decentralized devices are in this case connected in series in the transport network or, to be more precise, these decentralized switching devices are connected to these decentralized devices via the transport network, which is closed in the form of a loop.

As can also be seen, communications links exist between the individual decentralized switching devices CS1, CS2 and CSN via the transport network, with two of these being annotated 1N and 2N here. In this case, these are the virtual paths between the decentralized switching devices CS1 and CSN, or CS2 and CSN. This illustration shows that the use of virtual paths between the decentralized switching devices can result in a very complex structure. This is evident just from the description of the small number of virtual connections shown here. It can likewise be seen that the topology of the transport network can be kept very simple in comparison to this. The use of such permanent virtual paths in the transport network has the advantage that the connection setting-up times for communications links via the transport network between communications

subscribers is virtually constant for any desired decentralized devices, since the fact that virtual paths have been set up means that the number of relay stations involved in setting up connections, in the form of decentralized switching devices, is irrelevant The transport network is preferably in the form of an ATM network, since the standardized service feature for setting up virtual paths already exists for networks such as these. The virtual paths are advantageously initialized and set up in the transport network ~~only~~ once, when starting up the communications arrangement, and then exist throughout the period during which this arrangement is in operation. They are used by current communications links, in accordance with the control information which is sent via the control network, ~~only~~ by the call processing, which is carried out in the decentralized switching devices CS and is controlled via the control network, which is not illustrated here.

Figure 6 shows a further communications arrangement comprising three decentralized devices DZ1 to DZ3, in which central switching devices CS1 to CS3 are arranged. Virtual communication paths 12, 23 and 31 exist between the decentralized switching devices. In this case, the transport network 700 is in the form of a public ATM network. This means that the virtual paths 701, 702 and 703 run via a public network. In a situation where the decentralized switching devices CS1 to CS3 are connected to one another via a public network and no virtual paths are established between them, it is possible, when setting up a connection, for the delay times via the transport network to become so great that the standardized connection setting-up times can no longer be complied with, as defined in the communications standard used in such a communications arrangement. The setting up of virtual paths in the transport network, particularly in the case of public transport networks, thus advantageously ensures that the connection setting-up times via the transport network can be kept short.

Figure 7 shows a more complex communication arrangement, in which all the decentralized switching devices are connected to one another by virtual paths. For the sake of clarity, ~~only~~ the decentralized switching device CS1 is shown completely, and the other decentralized switching devices are numbered successively in sequence, by the numbers 2 to 16.

In this case, the transport network is in the form of a matrix-like row and column structure, which connects the individual decentralized switching devices to one another. Of these, only DZ1 is shown in the present example since, in the wider context, these contribute nothing to the understanding of the figure. The transport network thus comprises columns 701, 702, 703 and 704, which connect respective decentralized switching devices CS1, 5, 9, 13; 2, 6, 10, 14; 3, 7, 11, 15 and 4, 8, 12, 16 to one another. In the rows of the network, CS1, 2, 3, 4 are connected to one another by the transport network via 107, 5, 6, 7, 8 are connected to one another via 507, 9, 10, 11, 12 are connected to one another via 907, and 13, 14, 15, 16 are connected to one another via 1307. Even the use of 16 decentralized switching devices in a communications arrangement thus results in a highly complex transport network topology. However, the structure becomes disproportionately more complex if virtual paths are set up between the individual decentralized switching devices in order to keep the connection setting-up time via the entire communications arrangement constant between communications subscribers and any given decentralized devices. ~~Only the~~ The virtual paths for a single decentralized switching device 6 to ~~all~~ the other decentralized switching devices are shown here. However, it should be noted in this case that such a star-shaped virtual path configuration exists between ~~all~~ the decentralized switching devices 1 to 16. In detail, virtual paths 61, 62, 63, 64, 616, 613, 69 and 65 originate from 6 going to the other decentralized

switching devices, although it should be noted that, in order to make the illustration clearer, this figure does not show ~~all~~ the virtual paths. In order to ensure a short connection setting-up time for communications links via this communications arrangement between ~~all~~ the decentralized switching devices it is, however, necessary for ~~all~~ the decentralized switching devices to be connected to ~~all~~ the other decentralized switching devices via virtual paths.

An arrangement such as this in conjunction with the procedure for establishing a communications link ensures that the connection setting-up times and the delays associated with them between the individual decentralized switching devices occur ~~only~~ when starting up such a communications arrangement, during which process the virtual paths are initialized via the ATM network, while these times are short when actually setting up a communications link between communications subscribers who are connected to any given decentralized devices, since these links run via virtual paths.

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Description

Communications system

The invention relates to a method and an arrangement for setting up and clearing communications links, in particular for the purposes of a private branch exchange and the terminals connected to it.

Owing to the increasing amount of communications traffic resulting from the increasing number of communications subscribers, and from the increasing requirements for the amount of data to be transmitted, transmitting devices, in particular private branch exchanges, are subject to ever more severe requirements in terms of the amount of data to be transmitted by a communications link and the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM method (Time Division Multiplexing) in which communications data from different connections is transmitted in respectively defined time slots. A connection between different communications partners is produced by a switching matrix which, on the basis of control information, associates incoming time slots on an incoming connection with outgoing time slots on an outgoing connection. Such switching matrices generally have a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices such as these are subject to a further problem, in that the time slots can hold only a limited amount of data.

The object on which the invention is based is to specify a method and an arrangement for providing a communications link, which ensure a high level of flexibility with regard to adaptation to the number of

communications links to be provided, to the amount of communication traffic per connection, and to their physical extent, while one particular aim is to ensure that any time delay caused by switching has no disadvantageous effects on the handling of a connection.

This object is achieved according to the features of patent claim 1 for the method, and according to the features of patent claim 5 for the arrangement. Developments of the invention can be found in the dependent claims.

In the method according to the invention, a connection is advantageously set up by means of call processing via an already existing fixed connection element in the transport network since this means that there is no need for a possibly time-consuming connection process in the transport network at that particular time. This advantage becomes more important the greater the number of switching stations in the transport network that are involved in the connection when setting up a connection via different connection element paths.

In one development of the described method, the call processing is carried out particularly advantageously in decentralized switching devices since this makes it possible to achieve a high level of redundancy in the transport network, and, in the situation where a number of such switching devices are connected to one another, between which permanently established connection element paths are set up, the setting up of a connection in the transport network takes just as long, even via a number of decentralized switching devices, as if only two such decentralized switching devices were involved in the setting up of the communications links. This ensures that the setting up of connections between different communication subscribers in the

transport network requires approximately the same amount of time, and the number of decentralized switching devices that are actually involved in setting up the connection is of secondary importance.

In one development of the described method, such a communications link is set up particularly advantageously by means of virtual transport network connections since, with regard to the connection times, these offer approximately the same connection setting-up times as hard-wired connections, although the transport network topology can be kept very simple and can be designed in a flexible manner, to satisfy the requirements. This leads to a considerable reduction in the amount of wiring required.

In one particularly advantageous arrangement, the communications links are set up between communications subscribers via a transport network which is controlled by a control network, with decentralized switching devices in the transport network carrying out the connection tasks in the network. If there is a permanent communications link between at least two such decentralized switching devices, an arrangement such as this reduces the amount of time required to pass connections through the transport network.

Permanent = there is no need for setting up connections.

One development of the described arrangement has, particularly advantageously, a permanent connection in the form of a permanent virtual connection, since such permanent virtual connections can be set up independently of the network topology of the transport network at any given time, and no time is lost for setting up connections, since permanent connections are not set up dynamically as required, but may be set up

only once, on a static basis, independently of the requirement, and are then always available.

It is particularly advantageous for the transport network to be in the form of an ATM network, since the various network components for ATM networks are already available commercially, that is to say the technical complexity for setting up a transport network is as low as desired, and the setting up of permanent virtual connections is already available as a service feature for ATM networks.

In one development of the described arrangement, all the decentralized switching devices in the transport network are connected to one another in a particularly advantageous manner via permanent virtual connections since, in this way, the time for setting up connections between any given decentralized switching devices via the transport network is approximately constant, and is independent of the number of such decentralized switching devices that are involved in the setting up of the communications link via the transport network.

Exemplary embodiments of the invention will be explained in more detail in the following text with reference to figures, in which:

Figure 1 shows a conventional communications arrangement,
Figure 2 shows an example of a novel communications arrangement,
Figure 3 shows an example of a message sequence in a known switching system.
Figure 4 shows an example of a message sequence using time-slot-related connection information for the transport network.
Figure 5 shows a communications arrangement with permanent connections,

Figure 6 shows a communications arrangement with transport network connections via a public network, and Figure 7 shows a complex communications arrangement with virtual paths.

Figure 1 shows an example of a known private branch exchange 150 with two peripheral devices P1 and P2, to each of which a communications terminal KE1 and KE2, which operates on a digital or analog basis, is connected. These peripheral devices P1 and P2 are accommodated in the same physical area as the central device ZE1. By way of example, they are located in the same room or in the same cabinet as it. The terminals fill defined time slots in a PCM datastream (Pulse Code Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are respectively connected to subscriber line modules SLM01 and SLM02 which supply, or take from, the PCM datastream digital data which is intended for the respective terminals, or originates from the respective terminals, via time slots defined by signaling. These PCM datastreams are annotated by 100 and 200, respectively, in Figure 1. Furthermore, signaling connections are shown, which are annotated 110 and 210, respectively. It shall be noted that, in this case, this is only a logical representation and not a physical representation. However, in reality, the transport data and the signaling data are transmitted in the same connecting cable.

This figure also shows peripheral devices P1 and P2, as well as line trunk units LTUC1 and LTUC2, which control the data traffic to the subscriber line modules for the respective decentralized devices. The peripheral device P1 is supplied with signaling data via the line 110, and the peripheral device P2 is supplied with signaling data via the signaling line 210.

As can clearly be seen here, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are gathered and distributed by a signaling device DCL, and are interchanged between the central device ZE1 and the peripheral devices P1, P2. The call processing CP controls the setting up and clearing of connections and, for this purpose, controls, inter alia, appliance-specific interface functions DH which, for example, are in the form of program modules. In this case, setting commands 1 are produced for the switching matrix MTS. These setting commands essentially indicate which input of the switching matrix should be connected to which output in order to produce a communications link. The control and connection functions are thus carried out by a single physically integrated functional unit in the communications network.

Figure 2 shows an example of a flexible, high-performance arrangement for setting up communications links. By way of example, this arrangement shows the configuration of a private branch exchange 250.

Figure 2 uses the same reference symbols for the same components of the device as those shown in Figure 1. Turning now to Figure 2, it is immediately clear that this shows a separate transport network 700 and a separate control network 310/410. This configuration of a switching system has the advantage that already existing networks, such as public or private networks, can be used for the transport network. In this case, only the control network need be routed to the central device ZE2.

The digital or analog communications terminals KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLM01 and SLM02.

However, without any restriction to the invention, terminals are also feasible, and can be integrated, in an arrangement 250 such as this, which can be connected directly to the transport network 700, without any diversion, and without any SLMO. ATM terminals or even IP-based (Internet Protocol) terminals can thus also be connected.

As can also be seen, the decentralized devices DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used for connection tasks. Instead of this, the connection tasks are carried out by the transport network.

In this arrangement, at least one control information item, which is derived from time-slot-related control information, is in each case provided for setting up the communications link for this purpose, just for the respective decentralized switching devices CS1 and CS2, via the control lines 410 and 310. The figure furthermore shows that PCM data is converted to cell data in accordance with the standard for the transport network type 700, that is, for example, ATM cell data, on a respective data path 300 or 400. In this case, it should be noted that the use of an ATM network as the transport network is intended to be only an exemplary embodiment here. Ethernets, other IP links or even TDM links may likewise be used for this purpose. The choice is dependent on the intended application, and covers the entire range of available networks both in the narrowband field and in the broadband field.

Call processing is preferably carried out as a function of the transport network on the decentralized switching devices CS1 and CS2, but this is essentially restricted to the basic call functionality. Service features are

in this case provided by the central controller ZE2. Connections between the various decentralized devices are controlled by the central device ZE2 via signaling. The advantages of this control arrangement are that it can be used for both narrowband and broadband. Furthermore, the transport network will be set up on both public networks and private networks, or on a mixture of the two.

In simplified form and by way of example, Figure 3 shows a message sequence in a conventional communications system for setting up a connection between two peripheral devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, or control messages, runs from top to bottom. First of all, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then selected by entering dialing information, which is passed on from an appliance-specific interface module DH to the call processing CP for the subscriber A.

The selection code interpretation WABE of the dialed information leads to a message SEIZURE being passed on to the call processing CP for the subscriber B. An appliance-specific interface module DH, which has the responsibility there, assigns an explicit time slot, for example ZS1 for a defined PCM data path, for example PD1, to that connection, and generates the control message TSL_ASSIGN to the subscriber line module SLM01. This control message tells the subscriber line module SLM01 the explicit time slot ZS1 and the defined PCM data path PD1 which shall be used for that connection. The explicit time slot ZS1 in the PCM data path PD1 is applicable to the connection element between the subscriber line module SLM01 and the MTS. A second explicit time slot ZS2 in a second explicitly

defined PCM data path PD2 is applicable to the connection element between the MTS and the subscriber line module SLM02. The information ZS2 and PD2 is once again sent to the subscriber line module SLM02 in a control message TSL ASSIGN. Generally, TDM-based private branch exchanges use a TDM switching matrix MTS for the physical connection of individual subscribers. A setting command PATH_CONNECT1 is sent for this switching matrix and results in the time slot ZS1 from the PCM data path PD1 being connected to the time slot ZS2 for the PCM data path PD2. The two connection elements are thus connected to form a continuous path between SLM01 and SLM02.

Figure 4 shows, in simplified form and by way of example, a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. An ATM network is used, by way of example, as the transport network here. The time sequence of the messages, or signaling messages, is from top to bottom. A functional unit STMA converts the time slots of the PCM datastream to a cell stream of ATM cells. In Figure 2, one such device is integrated in each of the decentralized switching devices CS1 and CS2 and, for this reason, they are not shown separately.

The sequence differs from the sequence illustrated in Figure 3 only from the point where the setting command PATH_CONNECT1 is set for the TDM switching matrix. Instead of a setting command PATH_CONNECT1, a control message PATH_CONN2 is generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection in the transport network. When using an ATM transport network, by way of example, an ATMSVC (ATM Switched Virtual Connection) is set up by means of ATM signaling procedures.

The control message PATH_CONN2 must contain the time slot and data path information ZS and PD for this purpose, and this can be taken, for example, directly from the setting message PATH_CONNECT1. In addition, the central control device just needs to state the transport-network-dependent address of the decentralized switching device to which the connection is intended to be set up. This means that the data which must be provided for the central controller as information about the transport network is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device in turn determines the necessary addresses from the time slot and data path information ZS and PD. Association tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

The control message PATH_CONN2 may also contain other information, and the control message PATH_CONNECT may also be generated in a number of more specific versions. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also contain information about the desired bandwidth. Alternatively, the bandwidth information can also be interchanged directly between the subscriber line module and the switching device.

If, after receiving the PATH_CONN2, the decentralized switching devices set up a connection in the transport network 700, the user data is then transmitted via this transport network 700. The user data stream of the data path 300/400 between the subscriber line module and the decentralized device DZ is associated with a connection between DZ1 and DZ2 by mapping the time slot details ZS and PD to form a connection identifier for that connection.

This means that, although the sequences for setting up connections via the transport network on the central control ZE2 may be complicated, only these addresses need be passed on to the call processing of the transport network in order to produce a connection via it. Everything else is done by the transport-network-specific call processing.

According to this message sequence, the PATH_CONNECT command is thus replaced by call processing that is specific to the transport network. In order to allow TDM-based subscribers to be connected by means of decentralized switching devices independently of the transport network, it is necessary to convert time slots to transport units. This is done in a conversion unit such as an STMA, of which there is at least one for each decentralized device, and this is preferably looped into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway may be provided for this purpose.

The TDM-based subscriber modules communicate with the conversion unit via, for example, connections on the backplane motherboard of the respective decentralized device. A bus which connects all the modules to one another can be provided for this purpose on this motherboard. The setting commands for connection of the conversion unit are for this purpose preferably produced autonomously from the PATH_CONN2 message by the decentralized switching device.

However, the method is not restricted to dialed connections that are set up dynamically, but can likewise use an ATMPVC (ATMPVC Permanent virtual connection). The information relating to the address must then be exchanged for information controlling the use of fixed connections. Furthermore, other forms of

data transmission may also be used, such as IP connections.

Figure 5 shows the example of a communications system which is controlled by a control network and has a transport network 700. In these illustrated arrangements, the reference symbols are used analogously to the descriptions relating to the other figures. In the present example, three decentralized devices DZ1, DZ2 and DZN are shown, with dots being shown between DZ2 and DZN, which are intended to indicate that there may be any desired number of such devices between the decentralized device DZ2 and the decentralized device DZN, and these are likewise a part of such a communications arrangement.

Connection elements 71, 712, 72N lead from the transport network 700 to the decentralized switching devices CS1, CS2 and CSN, and are passed back via a further connection 7N7 into the transport network. This means that the decentralized devices are in this case connected in series in the transport network or, to be more precise, these decentralized switching devices are connected to these decentralized devices via the transport network, which is closed in the form of a loop.

As can also be seen, communications links exist between the individual decentralized switching devices CS1, CS2 and CSN via the transport network, with two of these being annotated 1N and 2N here. In this case, these are the virtual paths between the decentralized switching devices CS1 and CSN, or CS2 and CSN. This illustration shows that the use of virtual paths between the decentralized switching devices can result in a very complex structure. This is evident just from the description of the small number of virtual connections shown here. It can likewise be seen that the topology

of the transport network can be kept very simple in comparison to this. The use of such permanent virtual paths in the transport network has the advantage that the connection setting-up times for communications links via the transport network between communications subscribers is virtually constant for any desired decentralized devices, since the fact that virtual paths have been set up means that the number of relay stations involved in setting up connections, in the form of decentralized switching devices, is irrelevant The transport network is preferably in the form of an ATM network, since the standardized service feature for setting up virtual paths already exists for networks such as these. The virtual paths are advantageously initialized and set up in the transport network only once, when starting up the communications arrangement, and then exist throughout the period during which this arrangement is in operation. They are used by current communications links, in accordance with the control information which is sent via the control network, only by the call processing, which is carried out in the decentralized switching devices CS and is controlled via the control network, which is not illustrated here.

Figure 6 shows a further communications arrangement comprising three decentralized devices DZ1 to DZ3, in which central switching devices CS1 to CS3 are arranged. Virtual communication paths 12, 23 and 31 exist between the decentralized switching devices. In this case, the transport network 700 is in the form of a public ATM network. This means that the virtual paths 701, 702 and 703 run via a public network. In a situation where the decentralized switching devices CS1 to CS3 are connected to one another via a public network and no virtual paths are established between them, it is possible, when setting up a connection, for the delay times via the transport network to become so great that the standardized connection setting-up times

can no longer be complied with, as defined in the communications standard used in such a communications arrangement. The setting up of virtual paths in the transport network, particularly in the case of public transport networks, thus advantageously ensures that the connection setting-up times via the transport network can be kept short.

Figure 7 shows a more complex communication arrangement, in which all the decentralized switching devices are connected to one another by virtual paths. For the sake of clarity, only the decentralized switching device CS1 is shown completely, and the other decentralized switching devices are numbered successively in sequence, by the numbers 2 to 16.

In this case, the transport network is in the form of a matrix-like row and column structure, which connects the individual decentralized switching devices to one another. Of these, only DZ1 is shown in the present example since, in the wider context, these contribute nothing to the understanding of the figure. The transport network thus comprises columns 701, 702, 703 and 704, which connect respective decentralized switching devices CS1, 5, 9, 13; 2, 6, 10, 14; 3, 7, 11, 15 and 4, 8, 12, 16 to one another. In the rows of the network, CS1, 2, 3, 4 are connected to one another by the transport network via 107, 5, 6, 7, 8 are connected to one another via 507, 9, 10, 11, 12 are connected to one another via 907, and 13, 14, 15, 16 are connected to one another via 1307. Even the use of 16 decentralized switching devices in a communications arrangement thus results in a highly complex transport network topology. However, the structure becomes disproportionately more complex if virtual paths are set up between the individual decentralized switching devices in order to keep the connection setting-up time via the entire communications arrangement constant

between communications subscribers and any given decentralized devices. Only the virtual paths for a single decentralized switching device 6 to all the other decentralized switching devices are shown here. However, it should be noted in this case that such a star-shaped virtual path configuration exists between all the decentralized switching devices 1 to 16. In detail, virtual paths 61, 62, 63, 64, 616, 613, 69 and 65 originate from 6 going to the other decentralized switching devices, although it should be noted that, in order to make the illustration clearer, this figure does not show all the virtual paths. In order to ensure a short connection setting-up time for communications links via this communications arrangement between all the decentralized switching devices it is, however, necessary for all the decentralized switching devices to be connected to all the other decentralized switching devices via virtual paths.

An arrangement such as this in conjunction with the procedure for establishing a communications link ensures that the connection setting-up times and the delays associated with them between the individual decentralized switching devices occur only when starting up such a communications arrangement, during which process the virtual paths are initialized via the ATM network, while these times are short when actually setting up a communications link between communications subscribers who are connected to any given decentralized devices, since these links run via virtual paths.

Patent Claims

1. A method for setting up or clearing, as well as maintaining, a communications link,
a) in which control information is produced in a central control device (ZE), which control information is suitable for defining a link via a switching matrix (MTS) for time slot links for PCM data paths (100, 200),
b) in which this control information is used in order to control transport-network specific call processing (CP) in a transport network (700) for transporting communications data via a communications link, and in which the call processing (CP) is used to set up a communications link by using at least one connection element which is set up permanently in the transport network.

2. The method as claimed in claim 1,
in which the call processing (CP) is carried out by decentralized switching devices (CS) in the transport network (700), and the communications link is set up via a permanent connection element (12) between two decentralized switching devices (CS1, CS2).

3. The method as claimed in one of the preceding claims,
in which the communications links are set up via at least one permanent virtual connection (12, 23, 31).

4. The method as claimed in one of the preceding claims,
in which the communications link is set up via an ATM transport network (700).

5. An arrangement for setting up and/or clearing, as well as maintaining, a communications link,

a) which has a transport network (700) for providing a communications link,
b) which has a control network (310, 410) for controlling the setting up and/or clearing of the communications link,
c) which has first means for controlling the setting up and/or clearing of connections in the transport network (700) by means of the control network, with these means being arranged physically separately from the transport network,
d) and in which the transport network (700) has at least two decentralized switching devices (CS) for providing a communications link in the transport network, with there being at least one permanent communications link via the transport network (700) between the decentralized switching devices (CS).

6. The arrangement as claimed in claim 5, in which the permanent communications link is in the form of a permanent virtual connection (701, 702, 703).

7. The arrangement as claimed in one of claims 5 and 6, in which the transport network (700) is in the form of an ATM network.

8. The arrangement as claimed in one of claims 5 to 7, in which there are permanent communications links (61, 62, …) between all the decentralized switching devices (CS1,…, 16).

GR 99 P 2865

Abstract

Communications system

A method and an arrangement are specified for setting up and clearing communications links via a private branch exchange. The transport network for transporting the communications data is preferably in the form of an ATM network, and is controlled by a separate control network, which is separated from it. In one particular refinement, all the decentralized switching devices which are involved are connected to one another via the transport network with the aid of virtual paths. This ensures that the setting up of connections via the transport network needs the same amount of time between any given communications subscribers. The time delay caused by the process of setting up connections occurs only during the initialization process of the transport network, in which these virtual communications links are set up in the transport network.

Figure 7

FIG 1

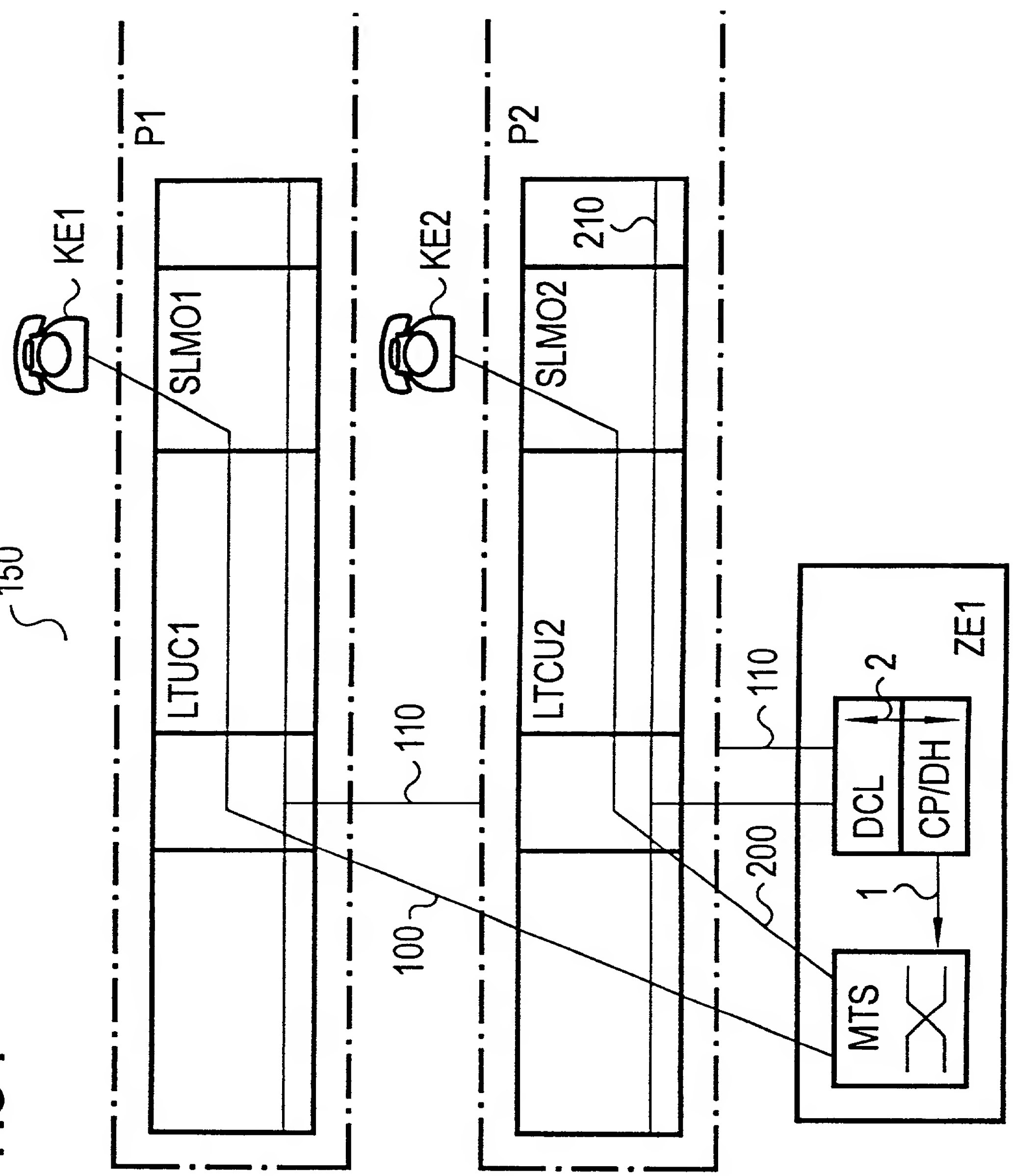

150
KE1
P1
SLMO1
LTUC1
110
100
KE2
P2
210
SLMO2
LTCU2
110
200
ZE1
2
DCL
CP/DH
1
MTS

FIG 2

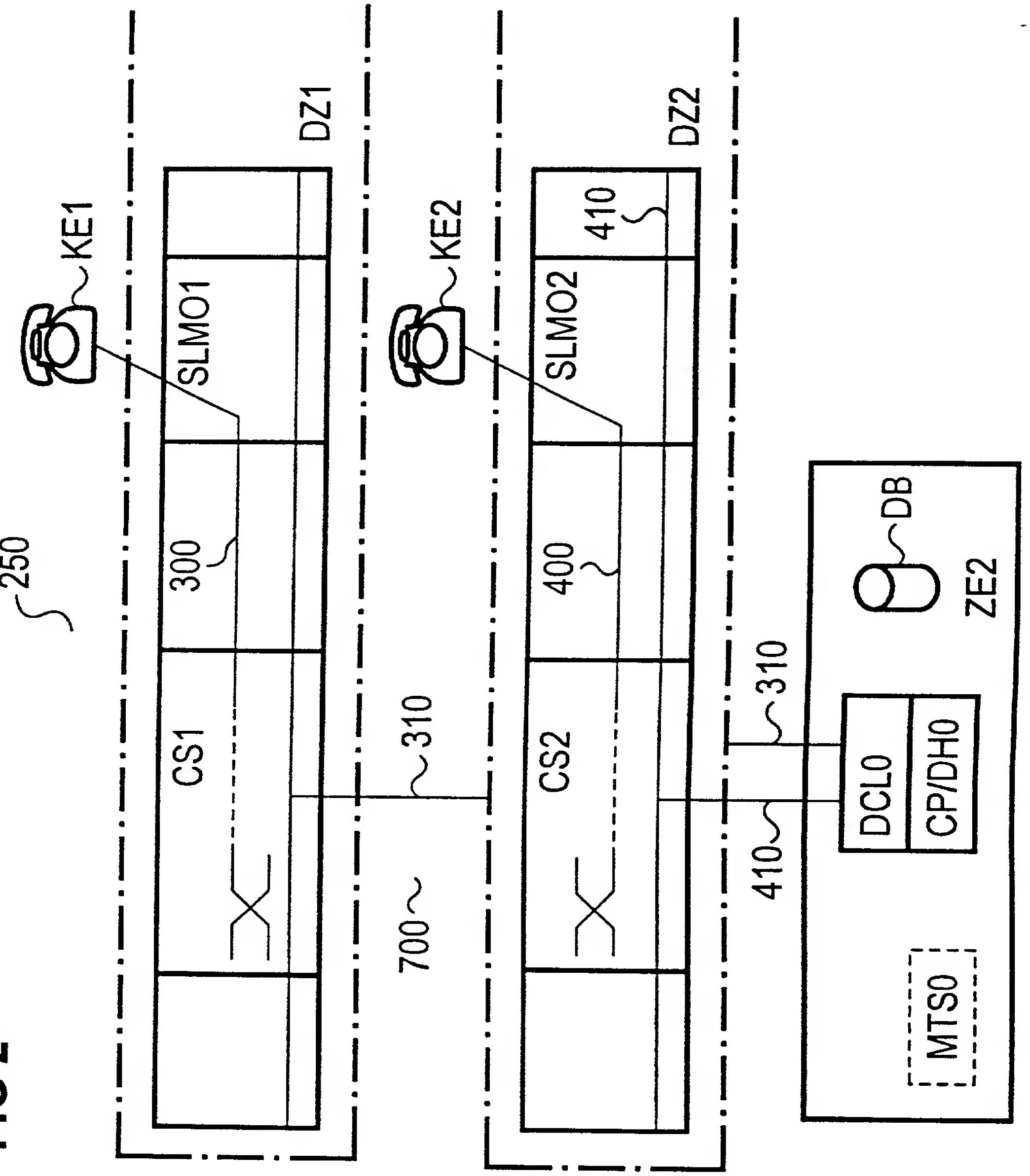

250
KE1
SLMO1
DZ1
300
CS1
310
700
KE2
SLMO2
DZ2
410
400
CS2
310
410
DCL0
CP/DH0
DB
ZE2
MTS0

FIG 3

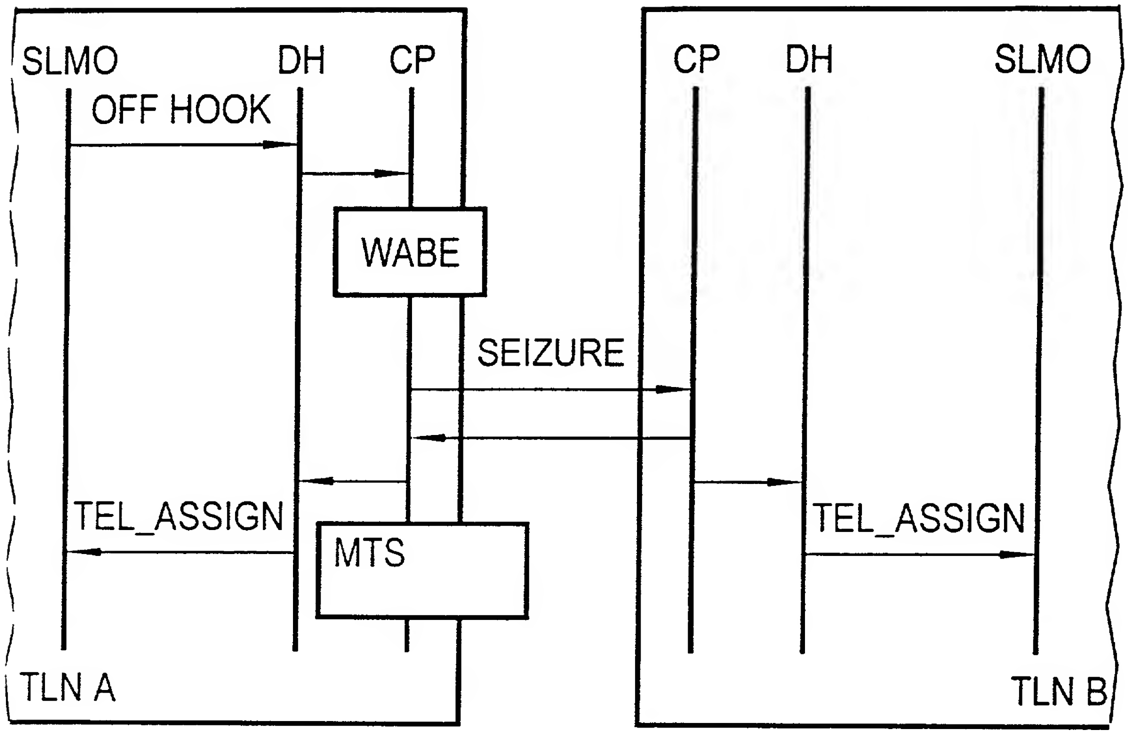

SLMO
DH
CP
OFF HOOK
WABE
SEIZURE
TEL_ASSIGN
MTS
TLN A
CP
DH
SLMO
TEL_ASSIGN
TLN B

FIG 5

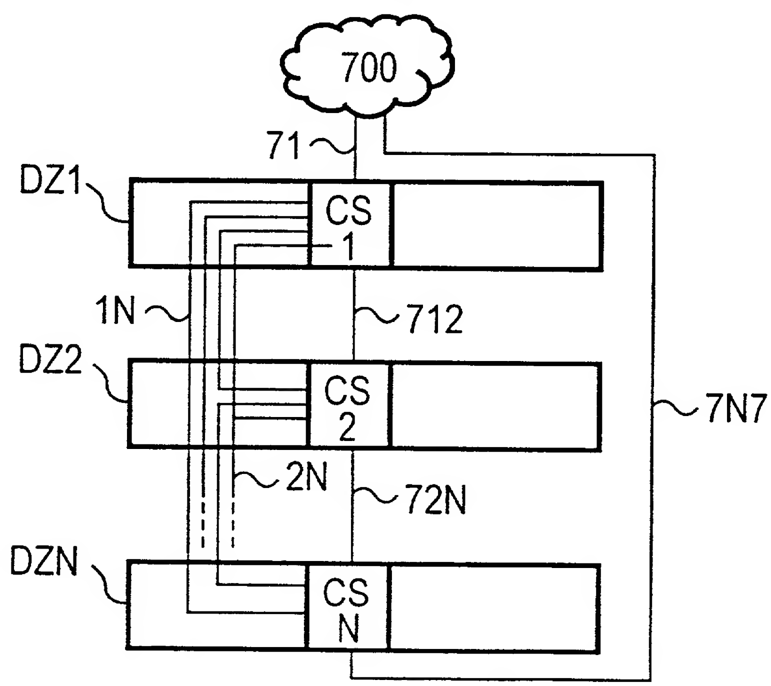
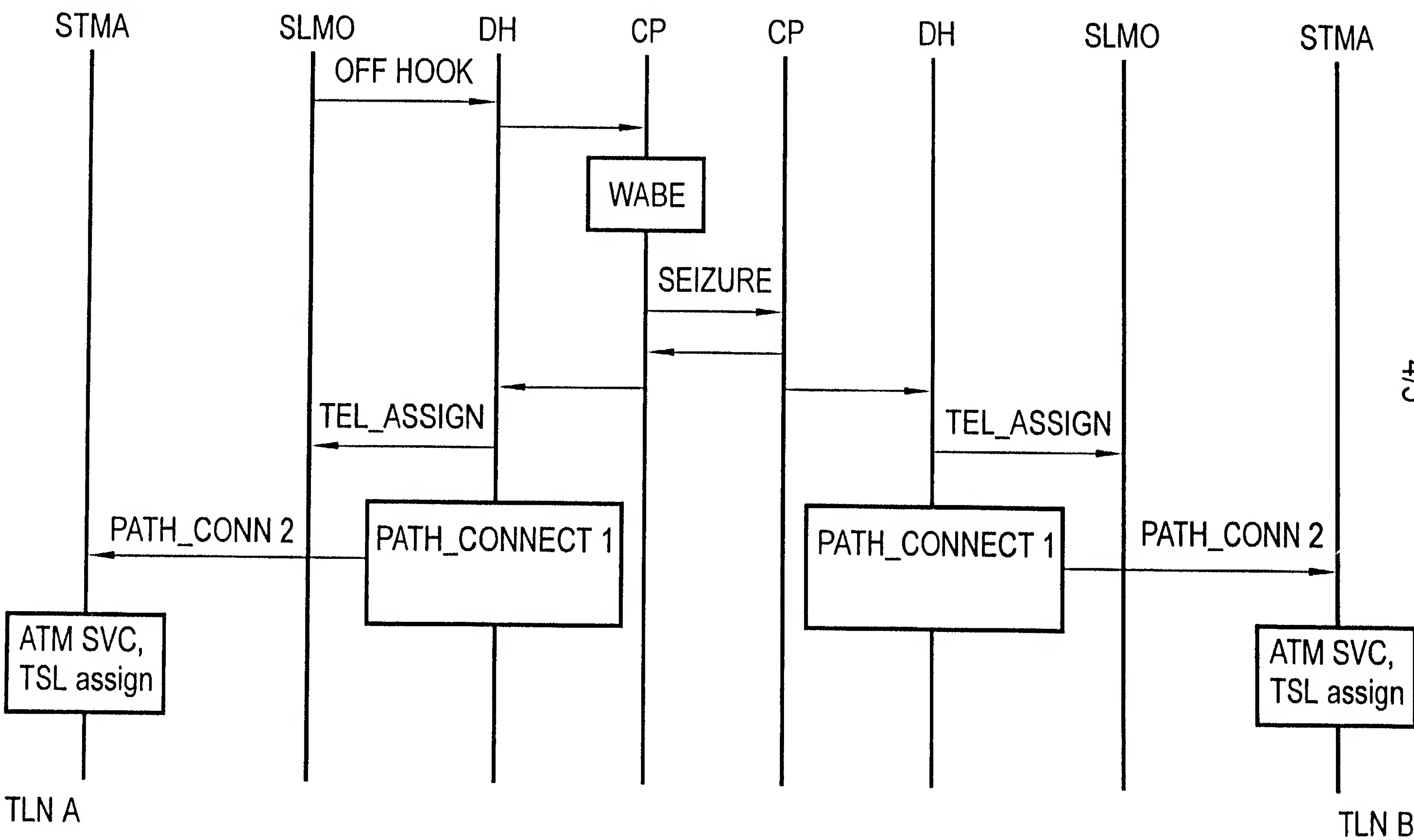

700
71
DZ1
CS 1
1N
712
DZ2
CS 2
7N7
2N
72N
DZN
CS N

FIG 4



STMA
SLMO
DH
CP
CP
DH
SLMO
STMA
OFF HOOK
WABE
SEIZURE
TEL_ASSIGN
TEL_ASSIGN
PATH_CONN 2
PATH_CONNECT 1
PATH_CONNECT 1
PATH_CONN 2
ATM SVC, TSL assign
ATM SVC, TSL assign
TLN A
TLN B

FIG 6

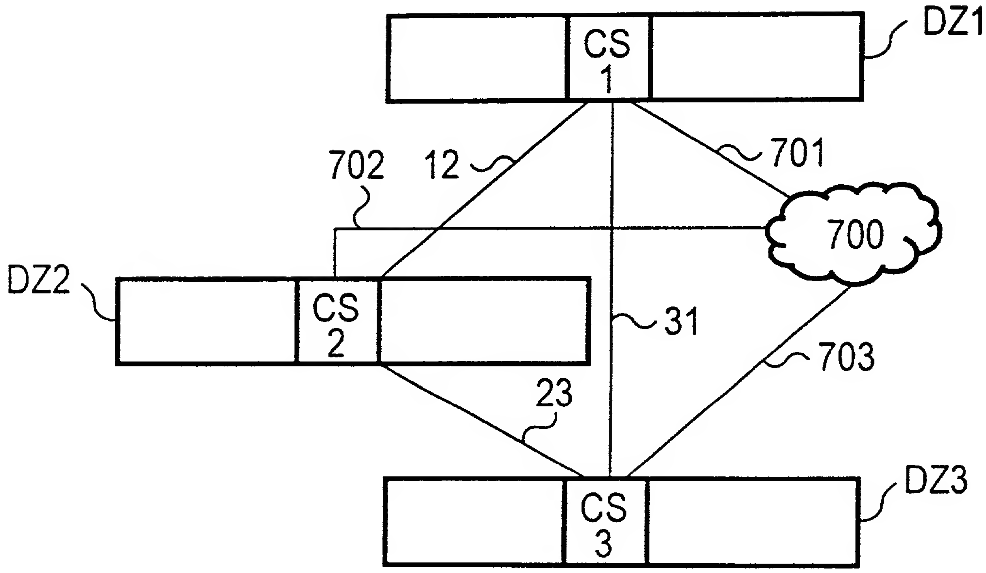
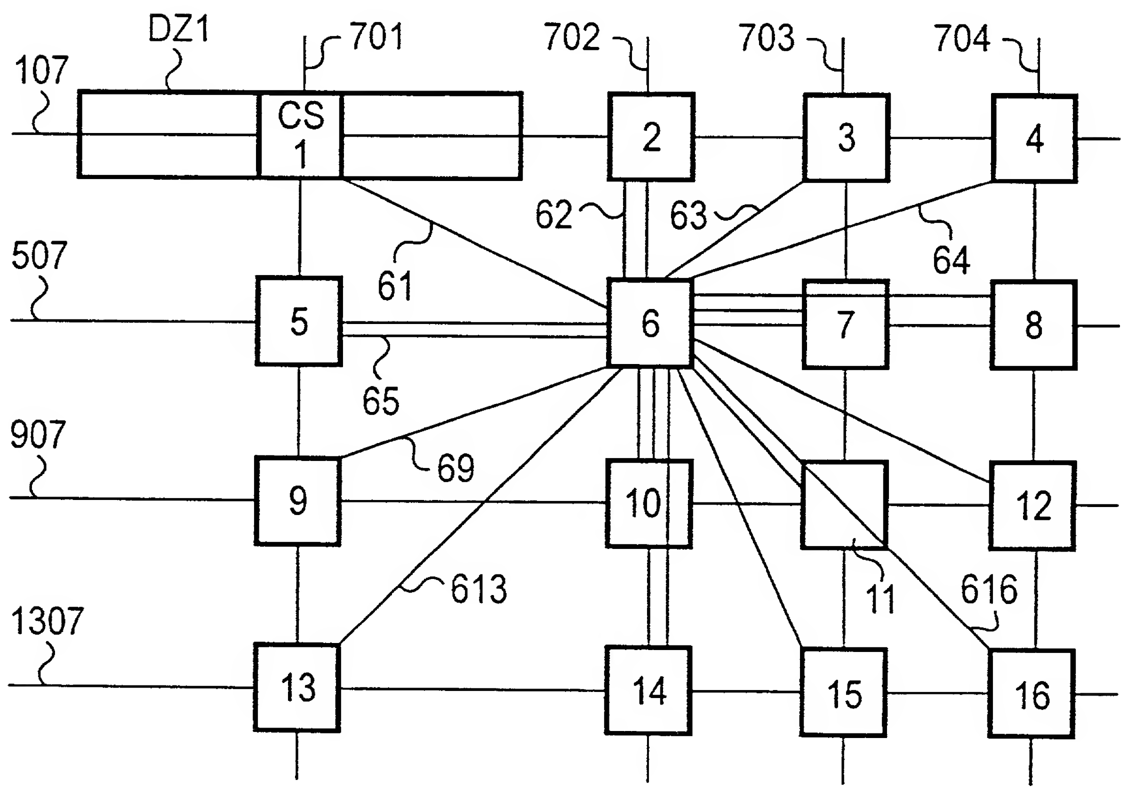

DZ1
CS
1
702
12
701
700
DZ2
CS
2
31
703
23
DZ3
CS
3

FIG 7


DZ1
701
702
703
704
107
CS
1
2
3
4
62
63
61
64
507
5
6
7
8
65
907
69
9
10
12
613
11
616
1307
13
14
15
16

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

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My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Kommunikationssystem

Communications system

deren Beschreibung

(zutreffendes ankreuzen)
☐ hier beigefügt ist
☒ am 18.09.2000 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/DE00/03239
eingereicht wurde und am ________
abgeändert wurde (falls tatsächlich abgeändert).

the specification of which

(check one)
☐ is attached hereto.
☒ was filed on 18.09.2000 as
PCT international application
PCT Application No. PCT/DE00/03239
and was amended on ________
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit auslandische Prioritatsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
19945159.1	DE	21.09.1999	☒	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
			☐	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
			☐	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/03239	18.09.2000	anhängig	pending
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D, M, Y) (Anmeldedatum T, M, J)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

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Telephone: (001) 202 887 1500 and Facsimile (001) 202 887 0763
or
Customer No. 25227

1. Voller Name des einzigen oder ursprünglichen Erfinders: Antonius Emmerink	Full name of sole or first inventor: Antonius Emmerink
Unterschrift des Erfinders [signature] Datum 4.3.2002	Inventor's signature Date
Wohnsitz: Muenchen, DEUTSCHLAND (DE)	Residence: Muenchen, GERMANY
Staatsangehörigkeit: NL	Citizenship: NL
Postanschrift: Ayingerstrasse 4	Post Office Address: Ayingerstrasse 4
81671 Muenchen	81671 Muenchen
2. Voller Name des zweiten Miterfinders (falls zutreffend): Egon Klein	Full name of second joint inventor, if any: Egon Klein
Unterschrift des Erfinders [signature] Datum 11.3.02	Second Inventor's signature Date
Wohnsitz: Germering, DEUTSCHLAND (DE)	Residence: Germering, GERMANY
Staatsangehörigkeit: DE	Citizenship: DE
Postanschrift: Muenchener Str. 14	Post Office Address: Muenchener Str. 14
82110 Germering	82110 Germering

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

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3) Voller Name des dritten Miterfinders: Rainer Windecker	Full name of third joint inventor: Rainer Windecker
Unterschrift des Erfinders: Rainer Windecker — Datum: 04.03.2002	Inventor's signature — Date
Wohnsitz: Muenchen, DEUTSCHLAND DEX	Residence: Muenchen, GERMANY
Staatsangehörigkeit: DE	Citizenship: DE
Postanschrift: Gustav-Heinemann-Ring 94, 81739 Muenchen	Post Office Address: Gustav-Heinemann-Ring 94, 81739 Muenchen
4) Voller Name des vierten Miterfinders: Steffi Winkler	Full name of fourth joint inventor: Steffi Winkler
Unterschrift des Erfinders: Steffi Winkler — Datum: 11.3.2002	Inventor's signature — Date
Wohnsitz: Gauting, DEUTSCHLAND DEX	Residence: Gauting, GERMANY
Staatsangehörigkeit: DE	Citizenship: DE
Postanschrift: Lulu-Beck-Weg 13, 82131 Gauting	Post Office Address: Lulu-Beck-Weg 13, 82131 Gauting
Voller Name des fünften Miterfinders:	Full name of fifth joint inventor:
Unterschrift des Erfinders — Datum	Inventor's signature — Date
Wohnsitz: ,	Residence: ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
Voller Name des sechsten Miterfinders:	Full name of sixth joint inventor:
Unterschrift des Erfinders — Datum	Inventor's signature — Date
Wohnsitz: ,	Residence: ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).